3.0 AVIATION ACTIVITY FORECAST

Forecasts must be both reasonable and defensible, since they can serve as the basis of future facility development requirements.

Forecasting aviation activity is a critical element in the Airport Master Plan (AMP) process since many development projects ultimately proposed within a master plan are based on aviation activity demand forecasts. For Front Range Airport (the Airport or FTG), the forecasts presented below are utilized in subsequent chapters to analyze Front Range Airport's ability to accommodate future activity and to determine the type, size, and timing of future airside and landside developments. In many cases, the decision to incorporate projects into an airport's long-term development plan is based on the anticipated levels of demand, including numbers as well as types of aircraft activity.

This chapter discusses the findings and methodologies used to project aviation demand at FTG for the 20-year planning window of 2017 through 2036. Per FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, aviation forecasts should be realistic, based upon the latest available data, reflect current airport conditions, and provide adequate justification for airport planning and development. The forecasts developed in this master plan are designed to provide a sound, defensible, and defined rationale to guide the analysis of future airport development needs and alternatives. However, while sound forecasting is essential for a successful master plan, it should be noted that it can only serve as an approximation of future activity based on historical data and present circumstances. There are many unforeseen factors can and do influence forecasts, both positively and negatively. For this reason, the operational forecasts included in this chapter, and the projects that they justify, should be periodically revisited to ensure that they remain appropriate.

2017 serves as the base year of the FTG AMP since it was the last completed calendar year prior to this effort. Forecasts are generated for the near-term (2022), mid-term (2027), and long-term (2037) time frames.

The amount and type of aviation activity occurring at an airport is dependent upon many factors, and usually reflect the services available to aircraft operators, the businesses located on the airport or within the host community, and the prevailing economic conditions within the surrounding area. The FTG forecast analysis includes methodologies that consider historical aviation trends at the Airport, the surrounding region, and throughout the nation. Projections of aviation activity for FTG were prepared for the short- (0-5 year), medium- (6-10 year), and long-term (11-20 year) periods, and to specify the existing and future Critical Design Aircraft. Aviation demand forecasts developed for FTG in this chapter are documented in the following sections:

- Data Sources

- Demographic and Economic Factors
- National and Regional Aviation Outlooks and Trends
- Forecasting Methodologies
- Forecasting Aviation Activity Measures and Metrics
- Review of Historical and Existing Forecasts
- Aircraft Operations Forecast
- Based Aircraft Forecast
- Critical Design Aircraft
- Summary of Preferred Forecasts

3.1 Data Sources

The following sources of data and guidance were used in the development of the aviation activity forecasts.

- **FTG Data Sources and Interviews:** Data was collected directly from Front Range Airport administration, as well as through interviews with key stakeholders including Air Traffic Control Tower (ATCT) staff, airport personnel, tenants and others. This information provided documented data not only with respect to actual operational numbers, but also regarding how and why those totals accrue at FTG. As part of this data collection effort, the Airport conducted an independent hangar inspection during the Summer of 2016 to establish an accurate total of based aircraft.
- **FAA Terminal Area Forecast (TAF)[1]:** Updated annually by the FAA, the TAF is used to determine federal budget and staffing needs, as well as a resource for airport operators, the general public, and other interested parties. Due to staff resource limitations, the FAA is not able to forecast in as great of detail at smaller airports as they typically do at larger airports. Nevertheless, the TAF does provide a guideline for developing forecasts, and is utilized as a basis for comparison with other scenario-driven forecasts. Generally, for the FAA to approve of an airport's master plan forecasts, those forecasts must be supported by an acceptable forecast analysis that is consistent with the FAA TAF.[2]
- **FAA AC 150/5070-6B, *Airport Master Plans*:** This AC contains key guidance that explains the steps required for the development of a master plan, including the preparation of aviation activity forecasts, the forecast methodologies to be employed, and what elements should be forecasted. This chapter conforms to the requirements of FAA AC 150/5070-6B.
- **FAA Form 5010-1, Airport Master Record:** The Airport Master Record contains aeronautical data describing the physical and operational characteristics of civil public-use airports, joint-use military airports, and private-use military airports that are active and included in the NAS. It contains airport data derived from both physical inspections of the airport,

[1] FAA Terminal Area Forecast, http://aspm.faa.gov/main/taf.asp
[2] FAA AC 150/5070-6B, Airport Master Plans, http://www.faa.gov/documentLibrary/media/advisory_circular/150-5070-6B/150_5070_6b_chg1.pdf

and the National Airspace System Resources (NASR) database. The most recent FAA airport inspection at FTG occurred on April 24, 2014.

- **ACRP Report: Airport Aviation Activity Forecasting[3]:** This 2007 report was also prepared by the ACRP and discusses methods and various potential forecast models, and practices for aviation activity forecasting. This report identifies ways to evaluate forecasts, uncertainties and accuracy in forecasts. The ACRP report also identifies common aviation metrics, issues in data collection and preparation, and data sources.
- **Forecasting Aviation Activity by Airport[4]:** Written by GRA, Inc. under contract to the FAA, this 2001 document provides guidance to individuals, and the FAA, when preparing airport activity forecasts. The FAA utilizes this guidance when developing the TAF.
- **FAA Aerospace Forecasts, Fiscal Years 2017-2037[5]:** The FAA annually prepares this document to explain the current economic and aviation outlook, as well as macro level forecasts of aviation activity and the U.S. aircraft fleet.
- **Colorado Department of Local Affairs[6]:** The Colorado Department of Local Affairs (DOLA) is the principal department of the Colorado state government responsible for: local government assistance, property taxation, property assessment appeals, affordable housing, and housing construction regulation. DOLA maintains a significant number of socioeconomic databases on a county level, including demographic forecasts through the year 2040.
- **Federal and State Data Sources:** Information was obtained from the State of Colorado and the U.S. Department of Commerce, Bureau of Economic Analysis, the U.S. Census Bureau, and the Bureau of Labor Statistics to support data needs as necessary, and described, throughout this section.

3.2 Demographic and Economic Factors

Demand for aviation is largely a function of demographic and economic activity, provided there is a causal relationship. When preparing forecasts, planners should consider socioeconomic data, demographics, disposable income, and geographic attributes. As mentioned in the previous section, socioeconomic data was collected from a variety of sources.

Potential correlation between local socioeconomic data with an airport's forecast for future aviation demand is considered through this forecasting effort. FTG socioeconomic data focused on Adams County, as collected and maintained by the Colorado Department of Local Affairs, the Bureau of Economic Analysis, the U.S. Census Bureau and the Bureau of Labor Statistics.

[3] Airport Cooperative Research Program Synthesis 2, Airport Aviation Activity Forecasting, http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_002.pdf
[4] FAA Aviation Data & Statistics, http://www.faa.gov/data_research/aviation_data_statistics/index.cfm?print=go
[5] FAA Aerospace Forecasts FY 2017-2037, www.faa.gov/data_research/aviation/aerospace_forecasts/
[6] Colorado Department of Local Affairs, January 2016, www.colorado.gov/pacific/dola

3.2.1 Population

The Colorado Department of Local Affairs reports that Adams County population grew from 395,384 people in 2005 to 480,317 in 2014, a 2.2 percent compound annual growth rate (CAGR), over that ten-year period. Over that same time frame, the State of Colorado's population grew from 4,662,534 (2005) to 5,343,471 (2014), a 1.4 percent CAGR, while the overall population of the U.S. grew at a 0.8 percent CAGR from 2005-2014.

3.2.2 Income

Adams County estimated per capita income increased from $33,607 in 2012 to $35,385 in 2014, a 2.6 percent average annual increase, with an average of $34,242 per the Bureau of Economic Analysis. Over that same period, the State of Colorado had an estimated per capita income increase from $44,266 in 2012 to $46,049 in 2014, a 2.0 percent average annual increase, with an average income of $44,918.

3.2.3 Employment

The ten-year (2005-2014) estimate for number of civilians employed in Adams County, as reported by the Colorado Department of Local Affairs, grew from 180,713 in 2005 to 225,545 in 2014, a 2.7 percent CAGR. This total represents approximately 47.0 percent of the 2014 county population, with the top industries including the following.

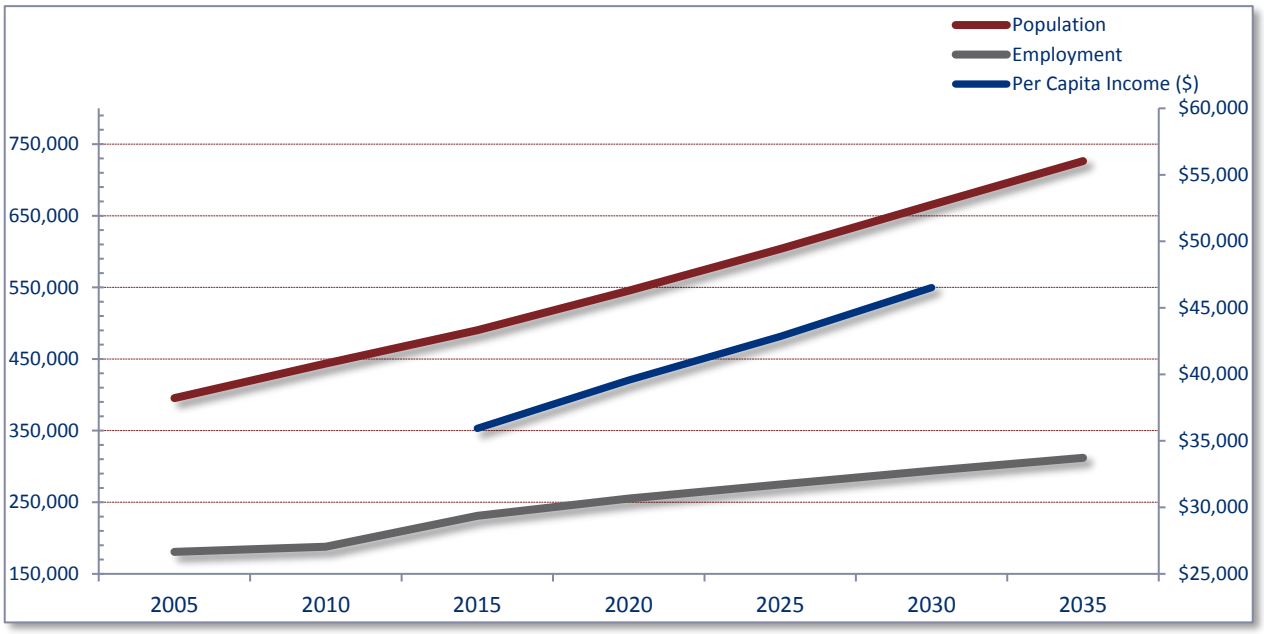
- Government (17.8 percent)
- Construction (11.0 percent)
- Retail Trade Construction (9.7 percent)
- Health Services (8.4 percent)
- Transportation and Warehousing (7.3 percent)

Within Colorado, over that same period, employment grew from 2,767,785 (2005) to 3,068,539 (2014), a 1.3 percent CAGR. Additionally, the Bureau of Labor Statistics reports that Adams County's 2014 unemployment rate of 5.7 percent exceeded Colorado's unemployment rate of 5.0 percent.

3.2.4 Adams County Socioeconomic Data Summary

Figure 3-1 provides a summary of the socioeconomic trends forecasted within Adams County through 2035.

FIGURE 3-1 - ADAMS COUNTY SOCIOECONOMIC TRENDS



Source: Colorado Department of Local Affairs; the Bureau of Economic Analysis

3.2.5 Regional Socioeconomic Conditions

Per Woods & Poole, the western region (consisting of the southwest, the Rocky Mountains, and the broad west regions) will experience the most growth of any region in the nation for the next 30 years. The population in the western region is forecast to increase by 43.9 million people between 2011 and 2040. By the year 2040, 36 percent of all Americans are expected to reside in the west; this is up from 24 percent in 1970 and 33 percent in 2011. Population growth also expected to generate 32.5 million jobs from 2010 to 2040, with a projected total U.S. job gain of 39 percent.

3.3 National and Regional Aviation Outlooks

3.3.1 FAA Aerospace Forecasts[7] FY 2017-2037

FAA prepares a national aerospace forecast every year to project commercial and general aviation (GA) activity levels so that the FAA can establish funding needs for various sections within the FAA, such as the Airport Traffic Organization (ATO). The forecast utilized in this chapter encompasses Fiscal Years 2017-2037, and looks at future economic conditions and assumptions, GA activity, commercial aviation activity, and air traffic control (ATC) workload. Some relevant highlights from the FAA's 2017-2037 forecast are presented in the excerpts from the report below.

- The long-term outlook for general aviation is stable to optimistic, as growth at the high-end offsets continuing retirements at the traditional low end of

[7] FAA Aerospace Forecast Fiscal Years 2017-2037. https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2017-37_FAA_Aerospace_Forecast.pdf

Pilatus PC12 Turboprop

Remos GX Light Sport Aircraft

Cessna Citation Jet

the segment. While steady growth in both national gross domestic product (GDP) and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet (fixed wing piston aircraft) continues to shrink over the forecast.

- The active general aviation fleet is forecast to increase 0.1 percent a year between 2016 and 2037, resulting in an increase in the fleet of about 3,500 units as increases in the turbine, experimental, and light sport fleets offset declines in the fixed wing piston fleet. The total active general aviation fleet increases from an estimated 209,905 in 2016 to 213,420 aircraft by 2037
- The largest segment of the fleet, fixed wing piston aircraft is predicted to shrink over the forecast period by 22,500 aircraft (at an average annual rate of -0.8 percent). Unfavorable pilot demographics, overall increasing cost of aircraft ownership, coupled with new aircraft deliveries not keeping pace with retirements of the aging fleet are the drivers of the decline.
- The smallest segment of the fleet, light-sport-aircraft (created in 2005), is forecast to grow by 4.1 percent annually, adding about 3,355 new aircraft by 2037, more than doubling its 2015 fleet size.
- The more expensive and sophisticated turbine-powered fleet (including rotorcraft) is projected to grow by 14,700 aircraft - an average rate of 1.9 percent a year over the forecast period, with the turbojet fleet increasing 2.3 percent a year. The growth in U.S. GDP and corporate profits are catalysts for the growth in the turbine fleet.
- Although fleet growth is minimal, the number of general aviation hours flown is projected to increase an average of 0.9 percent per year through 2037, as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed wing piston hours.
- Fixed wing piston hours are forecast to decrease by 0.8 percent, the same rate as the fleet declines. Conversely, hours flown by turbine aircraft (including rotorcraft) are forecast to increase 2.4 percent yearly over the forecast period. Jet aircraft are expected to account for most of the increase, with hours flown increasing at an average annual rate of 3.0 percent over the forecast period. The large increases in jet hours result mainly from the increasing size of the business jet fleet, along with estimated in-creases in utilization rates.

3.3.2 National Trends Impacting Future GA Activity

Aviation is a dynamic industry that is constantly adjusting to a variety of internal and external pressures. GA has experienced many significant challenges over the last twenty years that have dramatically impacted its future growth – and industry analysts anticipate more even more challenges to come. Several of those factors that could have the greatest impact on FTG are presented in the following sections.

National Economic Trends

There is a clear connection between GA activity on national and local levels and the general state of the national economy. The 2007 economic recession that significantly depressed corporate aviation activity, throughout the U.S. and global environment, also dramatically impacted piston-engine activity. The decline in

corporate aviation over that period clearly illustrates the close correlation between corporate aircraft activity and the performance of the stock market and corporate profits. With respect to the overall economy, the Congressional Budget Office (CBO) estimates that, in real terms, "GDP will expand at an average annual pace of 2.1 percent from the fourth quarter of 2016 to the fourth quarter of 2018, after having risen at an annual rate of 1.8 percent last year." In the longer term, the CBO projects actual and potential GDP alike will "expand at an average annual rate of 1.9 percent during the second half of the 10-year period. CBO estimates that the growth of potential output over that period will be faster than it has been since the 2007–2009 recession, mainly because the productivity of the labor force is projected to rise, returning closer to its average of the preceding two decades."[8] The FAA, and private companies, are optimistic about the long-term growth potential for corporate aviation. The Honeywell Business Aviation Forecast recently noted that it "sees 4.0 to 5.0 percent average annual industry growth over next decade with up to 9,250 deliveries of new business jets valued at over $250 billion expected through 2023. Although corporate activity has generally rebounded from the 2007 recession, corporate activity has not returned to the levels experienced prior to the economic downturn. Continued growth of the stock market and corporate profits are key factors to the long-term growth of corporate aviation activity.

Rising Cost of GA Aircraft Ownership

The cost of GA aircraft ownership has been rising faster than the overall rate of inflation for many years. A new Cessna 172, a mainline four seat single-engine piston aircraft, currently retails for almost $400,000, while other high performance single-engine piston airplanes retail from $700,000 to $1 million. Because of the high price point for entering the new aircraft market, many airplane owners have elected to continue to fly older, more affordable aircraft. With the average age of a GA aircraft in the U.S. now over 40 years old, costs for maintenance and replacement parts for those aircraft are increasing. Since much of GA activity is based on recreational and personal uses, the continued rising aircraft ownership costs are expected to have a dampening impact on overall activity levels.

Avgas Availability and Price

The amount of fuel used by most piston engine aircraft (100LL) sold in the U.S. has declined by more than 60 percent over the past 30 years. Market and environmental pressures have combined to make 100LL's availability occasionally limited and, at times, unavailable. It is projected that these pressures will ultimately result in the removal of 100LL from the marketplace. At present, there is no "drop-in" replacement for 100LL avgas that will work in all piston engines, although a coalition of industry groups, including the FAA, have recently tested four replacement fuels. Analysts are optimistic that more rigorous testing of two of those potential fuels will be completed by the end of 2018, at which point one or both fuels are expected to receive fleetwide authorization from the FAA to use in all piston-powered GA aircraft. Of course, if the replacement fuel is priced significantly higher than the current retail price for avgas, then overall GA activity will likely experience some decline even if replacement fuel is readily available.

[8] The Budget and Economic Outlook: 2017 to 2027. Congressional Budget Office. January 2017.

Security Regulations

The Department of Homeland Security's Transportation Security Administration (TSA) is charged with establishing protocols and maintaining security at airports within the U.S. While most new airport security regulations applied to airports with airline service (i.e. 14 CFR Part 139 airports), TSA has baseline airport and airspace security recommendations for all airports. Since one of GA's primary benefits for its users is the avoidance of security "hassles" at commercial service airports, the potential future imposition of new security requirements on GA airports would likely have a detrimental impact on operations.

Temporary Flight Restrictions (TFR) Impacts

TFRs are a combination of no-fly areas and designated areas for transient flights with strict conditions established to protect the transportation of the President of the United States. The imposition of TFRs reduces GA activity within a 50+ mile radius, adversely impacting many FBOs and other GA businesses. Airport managers and state aeronautic agencies have no discretion or input about when TFRs are imposed or how long they remain in effect. The National Business Aircraft Association (NBAA) noted: "TFRs do have a significant restrictive impact on general and business aviation."

Aging Pilot Population

According to FAA records, the number of total active licensed pilots in the US declined by 1.0 percent from 2007 to 2016, with licensed private pilots declining by 23.1 percent and commercial pilots decreasing by 16.5 percent over that same period[9]. This is the result of various factors including the pilot population aging faster than the general population, new, rigorous, FAA experience requirements for airline new hires, and an overall reduction of military flight training.

3.3.3 Regional Trends Impacting Future GA Activity

The Colorado Department of Transportation (CDOT) published the Colorado Aviation System Plan Update in 2011 to help assess, monitor, and plan for a system of airports that meet the State's long-term air transportation needs and support its overall economic goals. The System Plan notes that FTG is the ninth busiest GA airport in the state of Colorado in terms of aircraft operations (2010) (see **Table 3-1**)and ranked third in terms of the number of based aircraft with a total of 347 airplanes, as shown in **Table 3-2**. CDOT also classifies FTG as a Major General Aviation airport, the highest level in the system classification. Other airports in the Denver metropolitan area in the Major General Aviation airport category include Centennial Airport (APA) and Rocky Mountain Metropolitan Airport (BJC). Combined, FTG, APA, and BJC account for approximately 28.1 percent of all GA operations in the state of Colorado, and accommodate approximately 29.6 percent of all aircraft based in the state.

[9] 2016 Active Civil Airmen Statistics; https://www.faa.gov/data_research/aviation_data_statistics/civil_airmen_statistics/

TABLE 3-1 - TOP 20 COLORADO AIRPORTS BY GA OPERATIONS

Rank	City	Airport	2010 GA Operations	% Share
1	Englewood	Centennial Airport (APA)	275,030	17.1%
2	Pueblo	Pueblo Memorial Airport (PUB)	175,180	10.9%
3	Broomfield/Denver	Rocky Mountain Metropolitan Airport (BJC)	118,640	7.4%
4	Loveland	Ft. Collins/Loveland Municipal Airport (FNL)	106,570	6.6%
5	Greeley	Greeley/Weld County Airport (GXY)	106,250	6.6%
6	Erie	Erie Municipal Airport (EIK)	67,500	4.2%
7	Longmont	Vance Brand Municipal Airport (LMO)	61,210	3.8%
8	Colorado Springs	Colorado Springs Municipal Airport (COS)	59,120	3.7%
9	**Watkins**	**Front Range Airport (FTG)**	**58,220**	**3.6%**
10	Boulder	Boulder Municipal Airport (BDU)	50,280	3.1%
11	Colorado Springs	Meadow Lake Airport (FLY)	41,100	2.6%
12	Grand Junction	Grand Junction Regional Airport (GJT)	38,110	2.4%
13	Alamosa	San Luis Valley Regional Airport (ALS)	27,850	1.7%
14	Aspen	Aspen-Pitkin County Airport (ASE)	27,350	1.7%
15	Eagle	Eagle County Regional Airport (EGE)	24,560	1.5%
16	Durango	Durango La Plata County Airport (DRO)	20,110	1.2%
17	Montrose	Montrose Regional Airport (MTJ)	17,600	1.1%
18	Akron	Colorado Plains Regional Airport (AKO)	16,700	1.0%
19	Pagosa Springs	Stevens Field (PSO)	16,100	1.0%
20	Glenwood Springs	Glenwood Springs Municipal Airport (GWS)	14,930	0.9%
Subtotal			**1,322,410**	**82.1%**
Other Airports			**288,710**	**17.9%**
All Colorado Airports			**1,611,120**	**100.0%**

Source: 2011 CDOT Aviation System Plan, Technical Report, Table 2-10

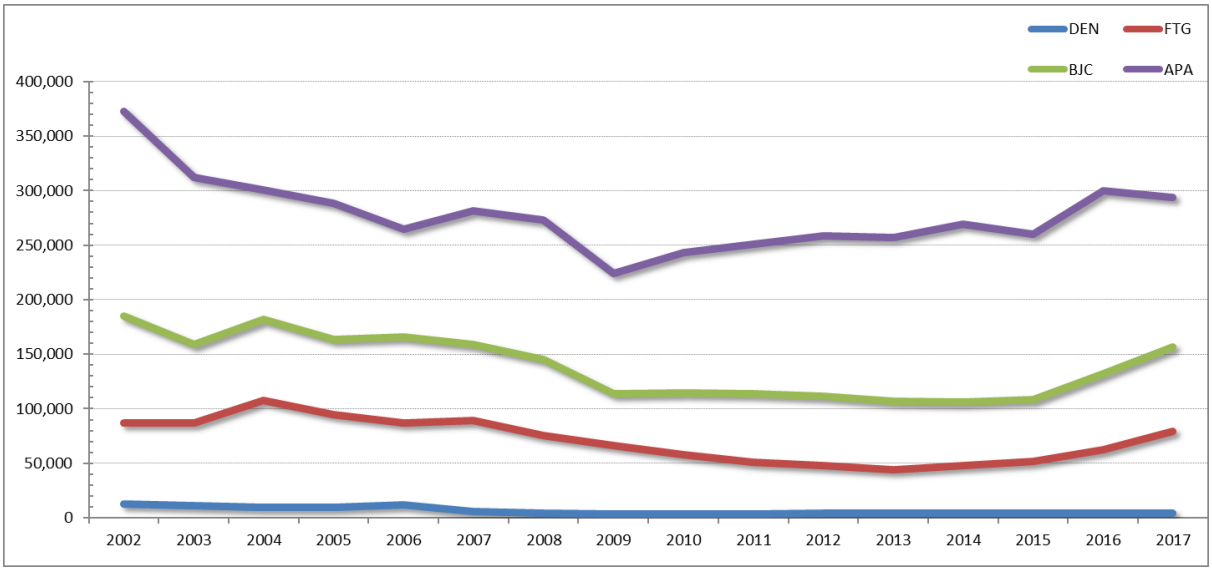
TABLE 3-2 - TOP 20 COLORADO AIRPORTS BY BASED AIRCRAFT

Rank	City	Airport	Based Aircraft	% Share
1	Englewood	Centennial Airport (APA)	822	15.7%
2	Broomfield/Denver	Rocky Mountain Metropolitan Airport (BJC)	384	7.3%
3	**Watkins**	**Front Range Airport (FTG)**	**347**	**6.6%**
4	Longmont	Vance Brand Municipal Airport (LMO)	340	6.5%
5	Colorado Springs	Meadow Lake Airport (FLY)	325	6.2%
6	Colorado Springs	Colorado Springs Municipal Airport (COS)	292	5.6%
7	Greeley	Greeley/Weld County Airport (GXY)	223	4.3%
8	Loveland	Ft. Collins/Loveland Municipal Airport (FNL)	216	4.1%
9	Erie	Erie Municipal Airport (EIK)	179	3.4%
10	Boulder	Boulder Municipal Airport (BDU)	159	3.0%
11	Pueblo	Pueblo Memorial Airport (PUB)	120	2.3%
12	Grand Junction	Grand Junction Regional Airport (GJT)	105	2.0%
13	Eagle	Eagle County Regional Airport (EGE)	100	1.9%
4	Canon City	Fremont County Airport (1V6)	88	1.7%
15	Montrose	Montrose Regional Airport (MTJ)	86	1.6%
16	Aspen	Aspen-Pitkin County Airport (ASE)	84	1.6%
147	Steamboat Springs	Steamboat Springs/Bob Adams Field	83	1.6%
18	Glenwood Springs	Glenwood Springs Municipal Airport (GWS)	73	1.4%
19	Hudson	Platte Valley Airpark (18V)	72	1.4%
20	Durango	Durango La Plata County Airport	70	1.3%
Subtotal			**4,168**	**79.5%**
Other Airports			**1,077**	**20.5%**
All Colorado Airports			**5,245**	**100.0%**

Source: 2011 CDOT Aviation System Plan, Technical report, Table 2-11

Based on that, it is reasonable to examine historical general aviation operational trends that have been experienced at these other airports (like BJC and APA) in comparison to FTG (see **Figure 3-2**). (Note the figure also includes Denver International Airport [DEN], a large hub commercial service airport that also accommodates a portion of the area's general aircraft operations.) All four have experienced net declines in overall GA activity over the past 15 years (2002-2017) with some recovery being experienced over the past three years. Overall since 2002, APA has lost 21.3 percent of its GA operations over that period, with BJC losing 15.4 percent, FTG losing 9.2 percent, and DEN losing 66.6 percent of their totals.

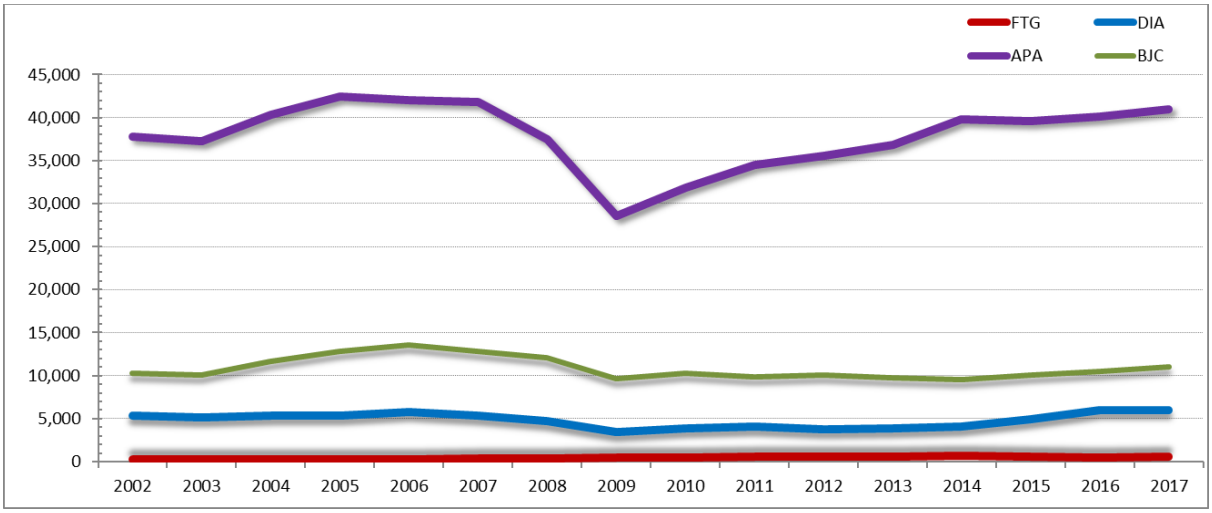
FIGURE 3-2 - GA AIRCRAFT OPERATIONS WITHIN THE REGION



Source: FAA Traffic Flow Management System Counts (TFMSC)

With respect to the business jet component of the GA market, these airports experienced operational levels consistent with the overall GA operational decline and the volatility experienced within the economy since 2002. **Figure 3-3** shows business jet activities experienced within the region between 2002 and 2017. FTG increased its business jet operations by 6.1 percent over that period, APA increased by 8.4 percent, BJC increased by 7.2 percent, and DEN increased by 11.1 percent.

FIGURE 3-3 - BUSINESS JET OPERATIONS WITHIN THE REGION



Source: FAA Traffic Flow Management System Counts (TFMSC)

Individual airports have little control over most factors that influence GA operational totals - they typically represent a mixture of national, and regional trends, some of which affect local GA activity. Local positive trends may counterbalance some of the impact from national challenges.

3.4 Forecasting Methodologies

There are several types of methodologies that can be used when developing aviation forecasts. Each forecast methodology must show short- (5 years), medium- (10 years), and long-term (beyond 10 years) periods, while keeping in mind that a forecast prepared using mathematical relationships must ultimately withstand the test of rational judgment. Each of these methodologies are used to develop forecasts for FTG GA aircraft operations and based aircraft. The different methodologies are briefly described below.

3.4.1 Time Series Analysis

A Time Series Analysis, also known as a trend or linear analysis, uses historic patterns of activity and projects the resultant trend into the future. The time series analysis is a regression analysis with time as the independent variable. The linear extrapolation uses the least squares method to fit a straight line between the historical points and continues to project that line into the future. This type of forecasting is widely used and highly valuable because it is relatively simple to apply. Its limitation is that it simply uses past historical data and variables that are not present in past data (such as change in fuel prices and any economic downturns) are not considered in the result.

3.4.2 Regression Analysis

Regression Analysis is a statistical technique that ties aviation demand (dependent variable), such as operations, to economic measures (independent variables), such as population, employment and per capita income. The independent variable is considered the explanatory variable because it "explains" the projected estimated value. The explanatory power of this approach is measured by the "R^2" statistic (called the correlation coefficient or the coefficient of determination). An R^2 helps determine if there is a correlation between the dependent and the independent variables. An R^2 of 0.0 represents that there is no statistical relationship between changes of the variable, an R^2 of 1.0 means that there is a perfect positive correlation, and an R^2 of -1.0 meaning that there is a perfect negative correlation. Regression analyses should be restricted to comparatively simple models with independent variables for which reliable forecasts are available. Most regression models for aviation use gross economic measures like income, population, and employment to forecast activity levels.

The Regression analysis models used in this forecast study include population, employment, and per capita income in Adams County. The compound annual growth rate (CAGR) in Adams County, between the years 2015 to 2040 is 1.9 percent for population and 1.5 percent for employment; per capita income is projected to climb at a rate of 1.7 percent through 2030.

3.4.3 Market Share Analysis

Market Share Analysis assumes a top-down model, and uses a relationship between national, regional, and local forecasts to predict trends at the Airport. This approach uses the forecast of large aggregates, such as the entire nation, to derive forecasts for a smaller area (i.e. airport). One example is to determine an airport's percentage

(market share) of the national enplanements and then forecast the airport's growth rate based on the national forecast growth rate. The market share analysis approach to forecasting is not without weaknesses. The national forecasts are composed of airports that are growing fast, growing slowly, those with no growth, and those that are declining. Since this analysis is based on the regional or larger aggregate, the planner must account for historical trends, as well as an understanding of the local airport market to better estimate the forecast.

The market share analysis used FTG's market share within both the FAA Northwest Mountain Region (ANM) (Colorado, Utah, Wyoming, Idaho, Montana, Washington, and Oregon), and the Airport's market share within the entire state of Colorado as reported by the TAF. FTG's historical market share of aircraft operations within Colorado and the ANM are utilized as a means of forecasting future growth.

3.5 Forecasting Aviation Activity Measures and Metrics

The forecasting parameters are determined by the level and type of aviation activity expected at FTG. As a commercial service airport, the forecast for FTG focuses on commercial passenger enplanements, as well as GA aircraft operations and based aircraft activity levels. The forecasts must also consider demographic and economic activity, because these are a primary forecast for aviation demand. As fully identified in **Section 3.4**, data sources for these metrics are from the FAA, Woods & Poole socioeconomic data, local socioeconomic data, and airport records.

3.5.1 Commercial Aviation

Commercial aviation consists of operating aircraft for hire to transport passengers or cargo on a scheduled and unscheduled basis. This can consist of scheduled air carrier service and unscheduled air service flights, such as air taxi/charter that operate on an on-demand basis. FTG is not currently served by a commercial air carrier nor is it projected to do so within the 20-year planning period. Therefore, the only commercial aviation operations projected for FTG will consist of air taxi/charter services.

3.5.2 General Aviation (GA)

GA is comprised of all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire. Forecasting metrics of GA activity normally consist of aircraft operations and the number of based aircraft.

Aircraft Operations

Generally, the most important activity forecast for airfield planning is the level and type of aviation demand generated at the airport, which is measured by aircraft operations. An aircraft operation is either a take-off or a landing of an aircraft. This activity identifies the critical aircraft and how adequate the airfield serves this, and similar, aircraft. It is by this demand that runway and taxiway requirements are defined.

Since FTG is serviced by an ATCT, operational data for the Airport is generally considered to be reliable. For 2017, the FTG ATCT reported a total of 82,315 operations. However, as described below in **Section 3.7**, this baseline operational figure required adjustment due to a unique operational condition at FTG.

Based Aircraft

Based aircraft forecasts identify the number of aircraft that are projected to be stored at FTG. This data is used to calculate the need for specific types of hangars and aircraft parking aprons. An Airport hangar inspection conducted in July 2016 serves as the baseline for this forecasting element. Based on the inspection, FTG documented 323 single-engine aircraft, 36 multi-engine aircraft, five business jets, and five helicopters, for a total of 369 aircraft (2016) based at FTG.

3.6 Review of Historical and Existing Forecasts

3.6.1 2004 FTG Master Plan Forecast

The purpose of presenting the 2004 Airport Master Plan forecast is to provide an overview of the projections and underlying assumptions that were applied in the previous master planning effort. This is done to review, assess, and adjust any of those assumptions based upon was FTG has experienced since those forecasts were established. **Table 3-3** below identifies passenger enplanements, air cargo operations, air cargo tonnage, GA operations, and based aircraft, as reflected in the 2004 Airport Master Plan.

TABLE 3-3 - 2004 FTG AIRPORT MASTER PLAN FORECAST

	2002	2011	2016	2021	CAGR (2002-2021)
PAX Enplanements	0	0	0	0	0%
Air Cargo Operations	0	5,762	7,311	21,057	13.84%
Air Cargo Tonnage (million lbs.)	0	40.3	51.2	147.4	13.85%
GA Operations	91,806	155,082	193,384	252,932	5.48%
Based Aircraft	273	481		558	3.64%

Source: 2004 FTG AMP, Jviation

As shown in the previous table, the 2004 Airport Master Plan anticipated air cargo playing a prominent role in the future of FTG. This was based on an assumption that Front Range and neighboring DEN would enter into a Joint Operating Agreement (JOA) to create a non-competitive and synergistic air cargo environment that would enable the two airports to open new markets and maximize operational efficiencies. This JOA did not ultimately materialize and no air cargo operators are currently based at FTG, with all primary cargo operators electing to operate at DEN.

Additionally, GA operations were forecasted to increase at a robust 5.5 percent CAGR based on continued strong growth in population, employment and personal income, as well as national and local trends. The projected view of GA has shifted significantly with several economic downturns, increased security considerations, increased insurance and maintenance requirements, declining pilot starts, an aging GA fleet,

alternative communication means, and other considerations impacting operational patterns since 2004. Upon review of these historical GA forecasts, the 2004 Airport Master Plan forecasted significantly more general aviation operations (231,849) and based aircraft (351) in 2015 than are currently being realized at FTG.

3.6.2 CDOT Aviation Forecast

In 2011, the CDOT Aeronautics Division completed the CDOT Aviation System Plan. This study was conducted to provide CDOT Aeronautics with a performance-based airport system plan forecasts for the 76 public-use airports in Colorado. **Table 3-4** shows the forecasts for FTG as part of this study.

TABLE 3-4 - CDOT STATEWIDE AVIATION FORECAST UPDATE FOR FTG

Type	2015	2020	2030	CAGR (2015-2030)
Enplanements	0	0	0	0.0%
Commercial Operations	0	0	0	0.0%
GA Operations	59,040	60,014	62,516	0.38%
Military Operations	684	684	684	0.0%
Total Operations	59,724	60,698	63,200	0.38%
Based Aircraft	352	358	373	0.38%

Source: Colorado 2011 Aviation System Plan

3.6.3 FAA Terminal Area Forecast

The FAA annually prepares a TAF for each airport in the NPIAS. It identifies all airports in the U.S. that are considered significant to the national aviation infrastructure network. The latest TAF for FTG was published in January 2018, and is presented in **Table 3-5**. The TAF currently forecasts that airports the size of FTG will have little or no growth. The TAF for FTG shows a marginal decline in operations over the 20-year planning period, in addition to limited growth in based aircraft. These forecasts are not always site specific, and traditionally the FAA uses a conservative approach when site specific data cannot be obtained.

TABLE 3-5 - FAA TAF FORECAST FOR FTG

	2017	2022	2027	2032	2037	CAGR
Total Enplanements	0	0	0	0	0	0.0%
Itinerant Operations						
Air Carrier	0	0	0	0	0	0.0%
Air Taxi and Commuter	467	467	467	467	500	0.34%
GA	30,810	31.818	31.818	31.818	31.818	0.16%
Military	611	611	611	611	611	0.0%
Total Itinerant	31,888	32,896	32,896	32,896	32,929	0.16%
Local Operations						
GA	48,945	48,984	49,724	50,474	51,238	0.23%
Military	1,729	1,729	1,729	1,729	1,729	0.0%

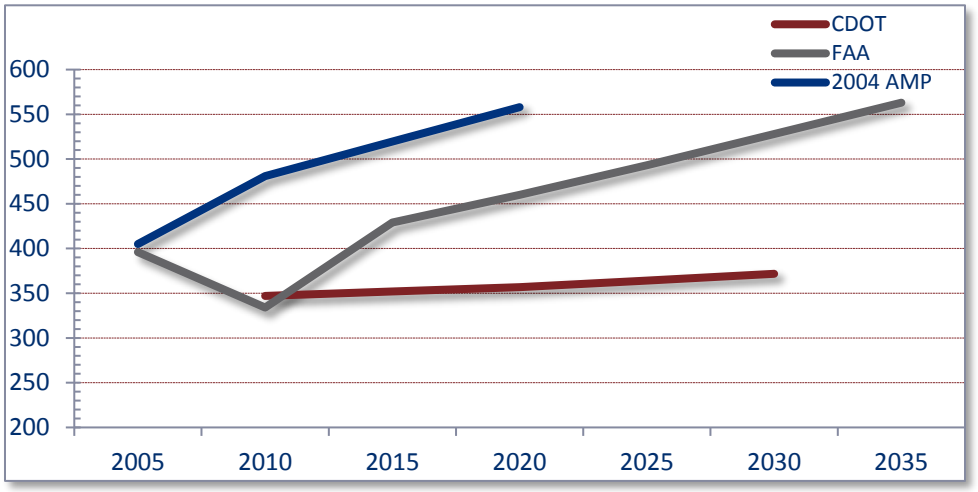
	2017	2022	2027	2032	2037	CAGR
Total Local	50,674	50,713	51,453	52,203	52,967	0.22%
Total Operations	82,562	83,609	83,349	85,099	85,896	0.20%
Based Aircraft	429	460	493	528	563	1.37%

Source: FAA TAF, Issued January 2018.

3.6.4 Previous and Existing Forecasts Comparison

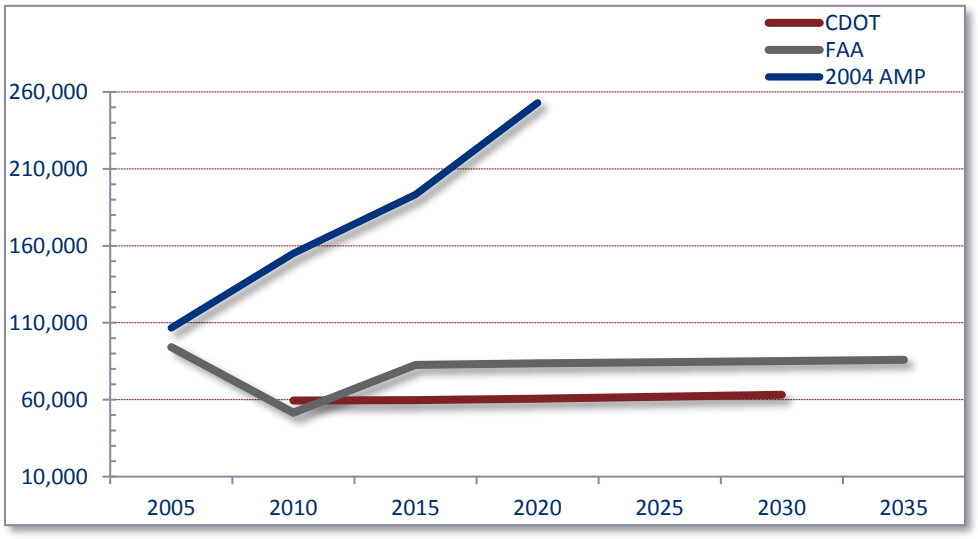
The following figures illustrate the differences among the FAA 2017 TAF, the CDOT System Plan forecasts, and the 2004 Airport Master Plan projections.

FIGURE 3-4 - PREVIOUS AND EXISTING FORECASTS OF BASED AIRCRAFT- FTG



Source: FAA 2017 TAF, 2004 FTG AMP, CDOT

FIGURE 3-5 - PREVIOUS AND EXISTING FORECASTS OF AIRCRAFT OPERATIONS



Source: FAA 2017 TAF, CDOT, 2004 FTG AMP

3.7 Aircraft Operations Forecast

As reported through the FAA's Air Traffic Activity System (ATADS), FTG had a total of 81,905 aircraft operations in 2017, which includes 439 conducted by air taxi/commuter aircraft, 2,198 by military aircraft, and the remaining 79,268 conducted by civil GA aircraft. While ATADS data (produced directly by the ATCT) is typically the most accurate traffic counts available on any airport, in the case of FTG, they do not reflect all of the operations currently being experienced at the Airport. Two primary factors contribute to this: the FTG ATCT is only open daily (and recording data) from 7 AM to 9 PM, and FTG currently has an air ambulance training company (Air Methods) that conducts the majority of its operations after dark, often when the ATCT is closed. In order to refine the ATADS data to properly reflect this operational condition, both the FTG ATCT and Air Methods were interviewed to identify where potential deficiencies in operational recording lay, as well as how to account for those deficiencies in a manner that was reasonable and minimized the potential for overestimating totals. Through that coordination, a methodology was developed to adjust the ATADS data to more accurately reflect current operations at FTG. Key assumptions made in that methodology include the following:

- Operational totals reported by airport administration (that include reporting by individual operators of their totals that occur both during and outside of ATCT hours) were averaged based on the totals reported the previous five years. This was done to ensure that the operational totals utilized were not an anomaly, but reflected a reasonable and normalized approximation.
- Based on the interviews, 30 percent of Air Methods' total reported operations were excluded from consideration since they were assumed to have occurred in non-movement areas, and therefore ineligible to be included in official airport operational totals.
- Since operational totals being missed by ATADS would be limited to only those that occur when both the ATCT is closed and it is dark, a comparative analysis of Denver area sunset and sunrise hours was conducted on a monthly basis with that of ATCT hours. Note that additional consideration was provided for dusk and dawn factors, as well as for daylight savings time.
- Additional corrective factors based on the interviews were also assumed to minimize the possibility for an overestimation of airport operational totals.
- Since this has the potential to impact FAA TAF operational baseline totals, the FAA was consulted about the approach and assumptions of this analysis - the FAA subsequently approved this methodology.

This methodology was discussed and approved by the FAA early in the master planning process to help account for those helicopter operations not being included in the ATADS data. The result of this methodology was to establish an adjusted baseline operational total for the forecast. (As an example, this methodology would result in the FTG operational total for 2017 being adjusted upward from 81,905 annual aircraft operations to 98,144 aircraft operations.) However, the Airport has also recently acknowledged that Air Methods operations are in the process of changing, with increased usage of flight simulators and fewer helicopters that will result in fewer of these uncaptured nighttime operations. Based on this, the Airport sponsor has elected to have the "official" annual operational total be consistent with

the ATADS data. However, it would also like to reserve the ability to re-establish the above methodology to adjust its official baseline annual aircraft operational totals as nighttime operations again become more prevalent.

The following sections describe the aircraft operational forecasts established for the various segments of aircraft activities at FTG.

3.7.1 Commercial Aviation Operations

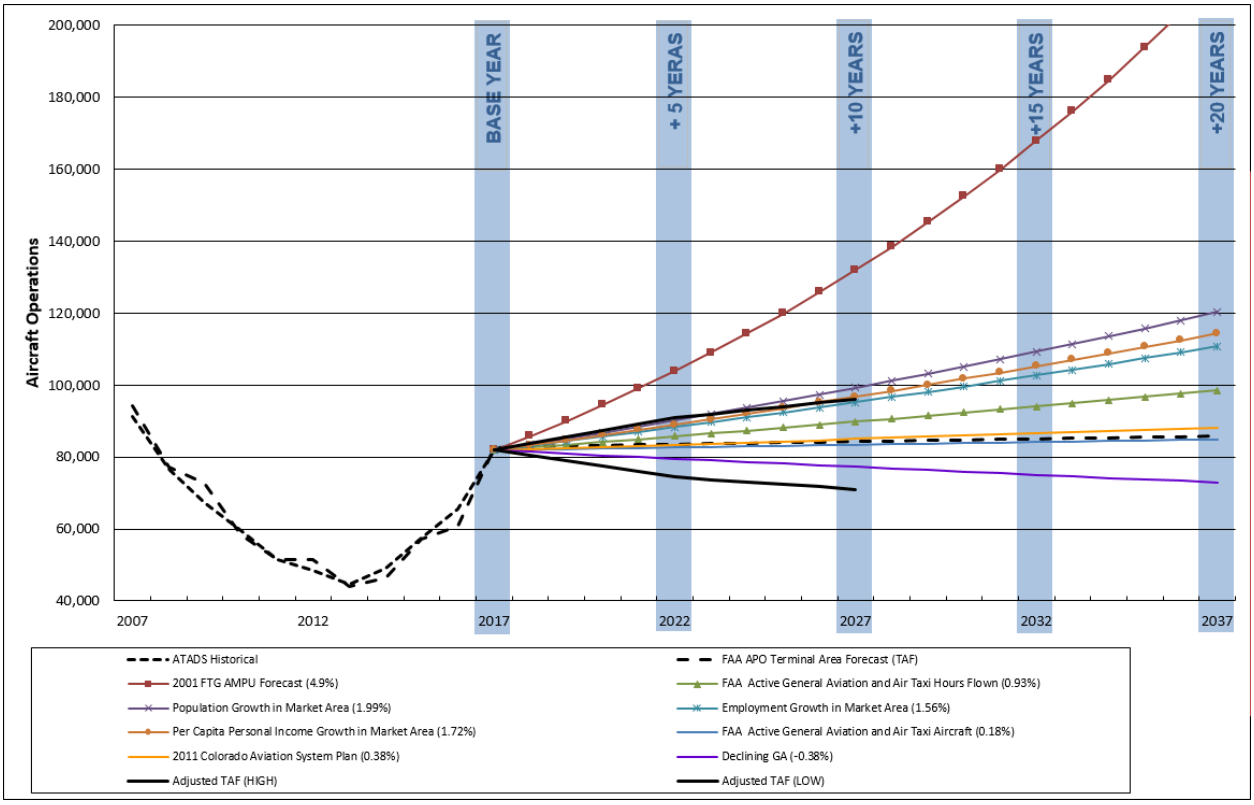
FTG does not currently have scheduled commercial air service, nor is it reasonably expected to accommodate such service within the planning period; a limited amount of air taxi/charter service is accommodated. Since these services largely mirror forecasting factors reflected in typical GA operations, the same methodologies are used for forecasting air taxi/charter operations.

3.7.2 General Aviation Operations

GA operations at FTG include all operations not classified as air carrier or military, and generally include those operations conducted by privately-owned aircraft used for business, recreation, flight training, and personal use. The methodologies used for forecasting GA aircraft operations included socioeconomic regression analyses, time series analyses, and market share analyses. Specifically, regression analyses were used for population, employment, and per capita income, while market share methodologies were based upon FTG's historical market share of aircraft operations within the ANM region (0.4 percent) and in Colorado (1.9 percent). Additionally, forecasts associated with the 2004 Master Plan, the 2011 Colorado Aviation System Plan, and the FAA Aerospace Forecast 2017-2037 were considered. Note that the times series analysis was not used for the operations forecast because continuing historical trends result in a projected continual decline in operations through the 20-year forecast period. The results produced through the application of these various methodologies and resources, as well as the historical FAA ATADS data and forecasted FAA TAF, are reflected in **Figure 3-6**.

As part of this effort, the FAA requires that study-related forecasts be consistent with the TAF or include sufficient documentation to explain the difference. Consistency with the FAA TAF is accepted if a forecast differs by less than 10 percent in the five-year forecast and 15 percent in the 10-year forecast. As a reference, this criterion is also included in **Figure 3-6**.

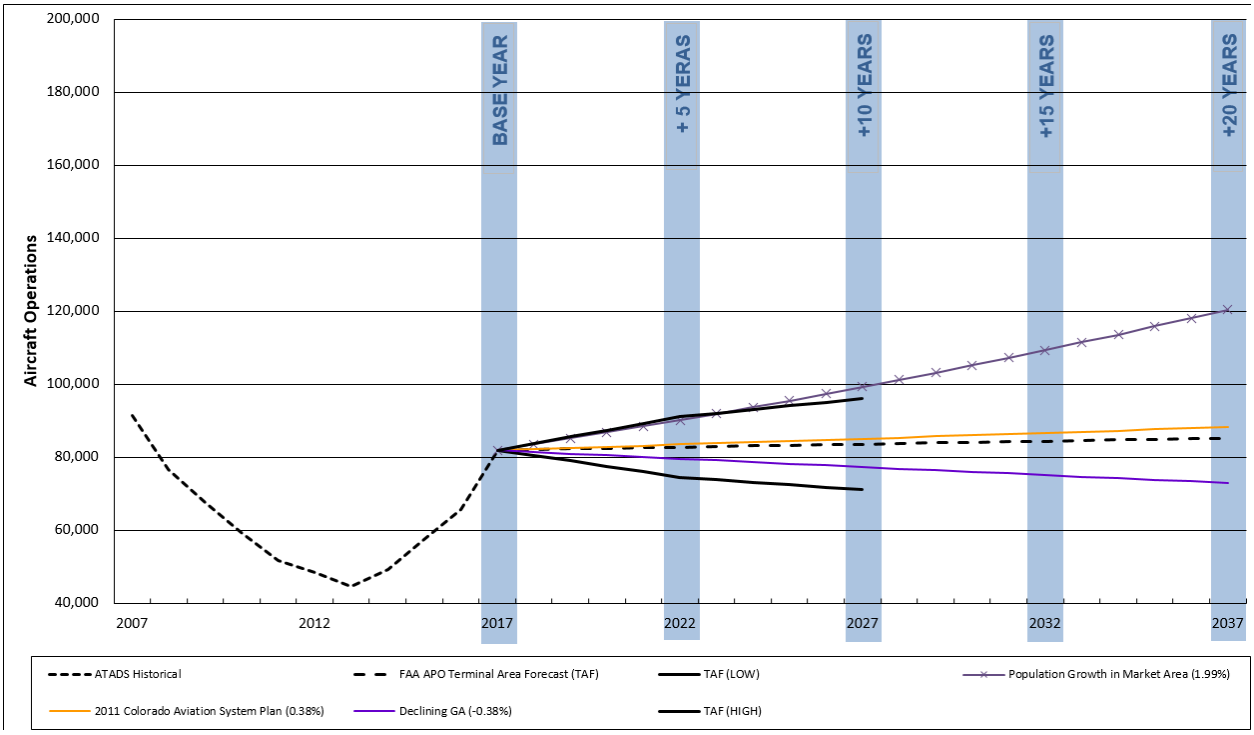
FIGURE 3-6 - FTG GENERAL AVIATION AIRCRAFT OPERATIONS FORECASTS



Source: Jviation

Three growth scenarios were used to forecast GA operations at FTG. The high growth scenario incorporates the Adams County population growth rate of 1.9 percent; the 2011 Colorado Aviation System Plan forecast for FTG (0.38 percent) reflects moderate growth, and a declining GA activity forecast (-0.38 percent) is the low growth scenario. These are reflected in **Figure 3-7** and **Table 3-6**. Note that these forecast scenarios provide a range of 120,333 (high) to 72,918 (low) GA operations by 2037, while the FAA TAF adjusted to the current operational level, projects 85,211 operations by the end of the 20-year planning period. With respect to the FAA TAF consistency criteria of forecasts differing by less than 10 percent in the five-year forecast and 15 percent in the 10-year forecast, only the high growth forecast does not comply, exceeding the criteria between years seven and ten.

FIGURE 3-7 - FTG AIRCRAFT OPERATIONS FORECAST SCENARIOS



Source: Jviation

TABLE 3-6 - FTG AIRCRAFT OPERATIONS RANGE OF FORECASTS

Year	High (1.99%) Adams County Population	Medium (0.38%) CO Aviation System Plan	Low (-0.38%) Declining GA	FAA TAF (2017I)	FAA TAF High / Low Range[2]
2017[1]	81,905	81,905	81,905	81,905	81,905
2022	90,144	83,442	79,553	82,718	90,990 – 74,446
2027	99,235	85,006	77,275	83,541	96,072 – 71,010
2032	109,265	86,602	75,064	84,372	-
2037	120,333	88,228	72,918	85,211	-

Source: Jviation

[1] Current (actual) data

[2] FAA requires recommended forecast scenario to differ by less than 10 percent from the existing TAF in the five-year forecast and 15 percent in the 10-year forecast, unless appropriate justification is provided. It does not apply beyond the ten-year forecast.

Additional Local Considerations

Adams County Economic Development

Beyond the primary socioeconomic trends for Adams County discussed previously, there are other economic initiatives that are important to recognize. The intergovernmental agreement between Adams County and City of Denver & Denver International Airport passed by voters in November 2015 (Denver Intergovernmental Agreements and Revenue Sharing with Adams County, Measure 1A) allows for the development of 1,500 acres of DEN property in exchange for tax revenues to be shared by the County and the City. This initiative is positioned as a pilot program for the potential long-term development of an "Airport City" or “aerotropolis” of businesses that would benefit from immediate proximity to DEN and have positive ancillary development impacts in surrounding communities. Because of the agreement, commercial non-aeronautical development will rapidly expand east, from the Denver metro area, into Adams County and towards FTG. The RTD rail line from Union Station to DEN and the new light rail line along the east side of Aurora , will also spur commercial and residential development. It is reasonable assume that the confluence of the various anticipated economic development initiatives and infrastructure investments will ultimately result in a significant boost to the socioeconomic underpinnings of Adams County – which in turn will positively impact FTG aircraft operational totals over the planning period.

Flight Training

While FTG experiences a significant amount of flight training, those aircraft are not currently based at Front Range. Most flight training operations originate at APA, FNL, BJC, GXY, and LMO, among others. A new flight school based at FTG may generate more traffic at the Airport in the short term; however, the presence and success of flight schools are largely driven by local area socio economics (i.e. population, employment, per capita income). While Adams County is displaying significant growth in all socioeconomic areas today and is projected to continue to do so into the future, the population density has not yet reached the point to make a flight school viable. It is reasonable to assume that as the economic foundation of Adams County continues to grow, and evolve from a rural character to that of a suburban or urban character, flight training operations based at FTG will occur within the near future.

Corporate Flight Departments

Like flight training, the presence of corporate flight departments based at an airport are largely a function of area socioeconomics. Corporate flight departments are typically based at airports that provide them with the facilities they need, the financial flexibility to assist in maintaining their operations, and the immediate accessibility required by their users (with respect to where they work and where they live). FTG meets the expectations of the first two requirements, yet the distance between FTG and the current metropolitan area population locus remains significant, albeit declining. As the Denver metro area development continues to progress east to Adams County, it is reasonable to anticipate an increase in the number of

corporate flight departments based at FTG, therefore positively impacting aircraft operational totals.

DEN and FTG Operational Dynamics

According to the FAA, DEN accommodates approximately ten times the number of corporate flight operations than FTG. This is attributed to a variety of factors, including the requirement of some corporate passengers to connect with commercial airline flights, corporate aircraft fueling and service agreements with established FBOs (i.e. Signature Flight Support), a closer physical proximity to the City of Denver, and the supporting highway network to facilitate efficient surface transportation to and around the City. As economic growth and transportation infrastructure improvements progress in and around Adams County, surface transportation efficiencies should improve dramatically, encouraging utilization of FTG over DEN. It is highly unlikely that corporate aircraft utilization of the two airports will balance within the planning period, however, thy may conform which would positively impact FTG's aircraft operational totals.

Spaceport Colorado

Building upon Colorado's extensive technology cluster of aerospace expertise, FTG and Adams County have embarked on an ambitious program to develop the first commercial spaceport in the State. Colorado has the nation's third-largest aerospace economy, and eight of the nation's top aerospace contractors maintain significant operations in Colorado. More than 400 space-related companies call Colorado home, developing products ranging from launch vehicles and satellites to command and control software, to sensors and navigation equipment. Specifically, the State has 160 businesses classified as being an "aerospace company," with more than 400 additional companies and suppliers providing space-related products and services. Direct employment in the Colorado aerospace market totals 25,110 private sector workers and approximately 27,890 military personnel. In turn these jobs support an additional 109,680 workers in other industries throughout Colorado through both direct and indirect impacts. In total, aerospace activities support an estimated 162,680 employees throughout Colorado.

Spaceport Colorado at FTG is envisioned as a horizontal launch facility, utilizing FAA-licensed Reusable Launch Vehicles or "space planes" that take-off and land from existing airport runways. These space planes would provide access to space for scientific research, education, and space tourism in the short-term; and point-to-point, high-speed, sub-orbital transportation to other international spaceports over the long term. FTG is in the process of filing an application to the FAA's Office of Commercial Space Transportation to be licensed as a commercial spaceport.

It is anticipated that the license and development of commercial space launch activities will also attract research and development (R&D) aerospace companies based at or near the Front Range to support commercial space ventures. Based on previous analyses, FTG appears to have adequate space and infrastructure available to accommodate a significant amount of aerospace-related development on airport property. If based at FTG, it is reasonable to assume that R&D aerospace firms and companies that fly the "space planes" will spur conventional corporate aircraft operations at FTG. It is anticipated that space-related development at FTG may occur

by 2021, and increase thereafter. While it is difficult to speculate how much additional aircraft activity will be generated by aerospace companies based at FTG, currently licensed commercial spaceports (i.e. Cecil Spaceport Field, FL; Mojave Air & Space Port, CA; Space Florida, FL; and Ellington Field, TX) anticipate conventional aviation activity growth in support of their spaceport activities.

FIGURE 3-8 - SPACEPORT COLORADO - DESIGN CONCEPT

Source: Spaceport Colorado

3.7.3 Local/Itinerant Operations

Local operations are those performed by aircraft that are based at FTG and operate in the local traffic pattern and/or within sight of the Airport. These operations also include simulated instrument approaches, and departures to or arrivals from practice areas within a prescribed distance from the Airport. Itinerant or transient operations are operations by aircraft that leave the local airspace.

The current FAA TAF indicates that total itinerant operations (air taxi/commuter, military and GA) were 39.9 percent and local GA operations were approximately 60.1 percent. For the purposes of this study, the majority of operations at FTG are expected to remain local; however, it is anticipated that FTG will experience a modestly increased rate of itinerant traffic over time to reflect increased regional economic development and associated business aircraft activities. Thus, the average itinerant/local split for total forecast operations from 2017-2037 is projected to be 45.0 percent itinerant and 55.0 percent local. Note that these percentages may be impacted by factors like the establishment of a flight school, the further development of corporate business hangars, and enhanced FBO services.

3.7.4 Design Hour Operations

Another measure of airport activity is design hour operations. The design hour is an estimate of an airports peak hour of the average day in the busiest month. Based on data obtained from the FTG ATCT, design hour calculations include the following.

- Peak Month Operations is the month that has the most operations. The Peak Month for FTG is typically June, July, or August at approximately 11.0 percent of the annual operations. FTG's peak month in 2017 was June, with approximately 9,993 peak month operations or 12.2 percent of the annual total.
- Design Day is the Peak Month Operations divided by 30 days. The Design Day for FTG in 2017 was 333.1 operations.
- Design Hour is an average of the highest number of operations within the most active hour of the day. Typically, these operations will range between 12.0 percent and 17.0 percent of the design day operations; for planning purposes, 15.0 percent was used to determine the Design Hour. The Design Hour Operations at FTG in 2017 is 50.0.

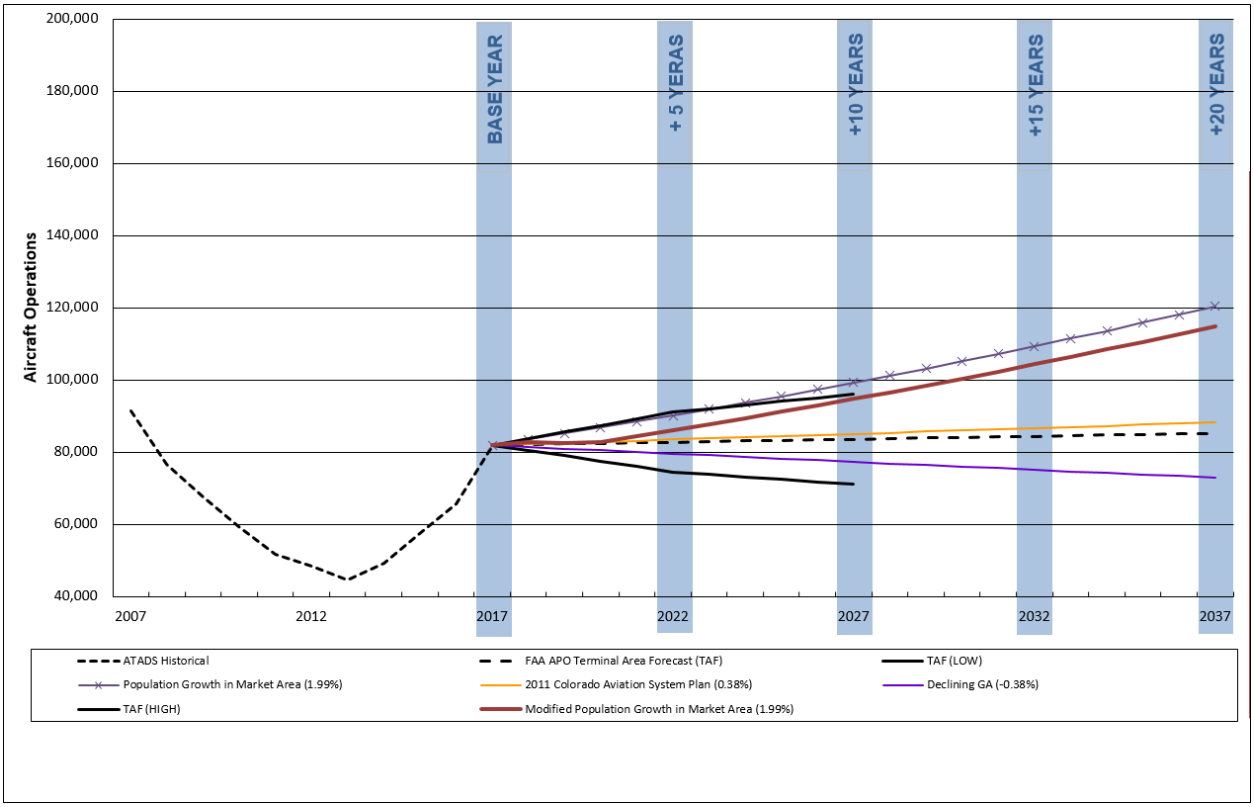
3.7.5 Military Operations

Military operations, historically, have not significantly contributed to the number of operations at FTG. Military operations are not dependent on the same stimuli as GA or commercial activity. Airport management records report that military operations at FTG are unpredictable and have fluctuated from year to year. The TAF indicates that military operations remain constant with 2,198 annual operations occurring throughout the 20-year planning period. This accounts for approximately 2.5 percent of FTG's total operations as projected in the TAF. Due to the fluctuation and unpredictability of military operations, this study projects, it is projected that military operations will remain constant throughout the forecast period.

3.7.6 Aircraft Operations Forecast Summary

The previous forecast scenarios were presented to the FAA and the FTG AMP Project Advisory Committee (PAC) in February 2016. Following comments received from the PAC and through additional interviews with stakeholders that included several PAC members, an additional forecast was developed that combined the high growth scenario (Adams County population growth) with the medium growth scenario (Colorado Aviation System Plan). This scenario assumes that FTG operational growth will lag slightly behind Adams County population growth, but that this growth will start to be realized by 2021. Specifically, this modified high growth scenario projects continued moderate (0.38 percent) growth through 2020 at which time growth would reasonably be expected to progressively increase to 1.9 percent. The modified high growth forecast scenario is shown below in **Figure 3-9** and **Table 3-7**. (Note that this forecast also lies within the FAA 10 percent and 15 percent range of the updated TAF.)

FIGURE 3-9 - FINAL FTG AIRCRAFT OPERATIONS FORECAST SCENARIOS



Source: Jviation

TABLE 3-7 - FINAL FTG AIRCRAFT OPERATIONS RANGE OF FORECASTS

Year	High (1.99%) Adams County Population	Modified High (0.38% / 1.99%) Adams County Population	Medium (0.38%) CO Aviation System Plan	Low (-0.38%) Declining GA	FAA TAF (2017)	FAA TAF High / Low Range[2]
2017[1]	81,905	81,905	81,905	81,905	81,905	81,905
2022	90,144	86,045	83,442	79,553	82,718	90,990 – 74,446
2027	99,235	94,712	85,006	77,275	83,541	96,072 – 71,010
2032	109,265	104,273	86,602	75,064	84,372	-
2037	120,333	114,823	88,228	72,918	85,211	-

Source: Jviation

[1] Current (actual) data

[2] FAA requires recommended forecast scenario to differ by less than 10 percent from the existing TAF in the five-year forecast and 15 percent in the 10-year forecast, unless appropriate justification is provided. It does not apply beyond the ten-year forecast.

Of the four forecast scenarios presented in the previous table, the modified high forecast was identified as being the preferred projection of aircraft operations for this master plan. That forecast generally reflects the extensive growth currently being realized and projected to continue to occur within the region. However, to project a realistic timing of when such regional development will ultimately impact FTG operations, it conservatively projects typically modest operational growth until 2020.

By that time, it is reasonable to assume that development associated with "Airport City," Spaceport Colorado, as well as general eastward development of the Denver metropolitan area should begin to more significantly impact FTG operations. **Table 3-8** presents a detailed description of the preferred forecast that includes the projected split of itinerant and local operations for the planning period.

TABLE 3-8 - FTG AIRCRAFT OPERATIONS PREFERRED FORECAST

Year	Itinerant Operations	Local Operations	Total Operations
2017[1]	32,672	49,233	81,905
2022	35,278	50,767	86,045
2027	40,726	53,986	94,712
2032	44,837	59,436	104,273
2037	51,670	63,153	114,823
Percent Split (2037)	**45%**	**55%**	**100%**

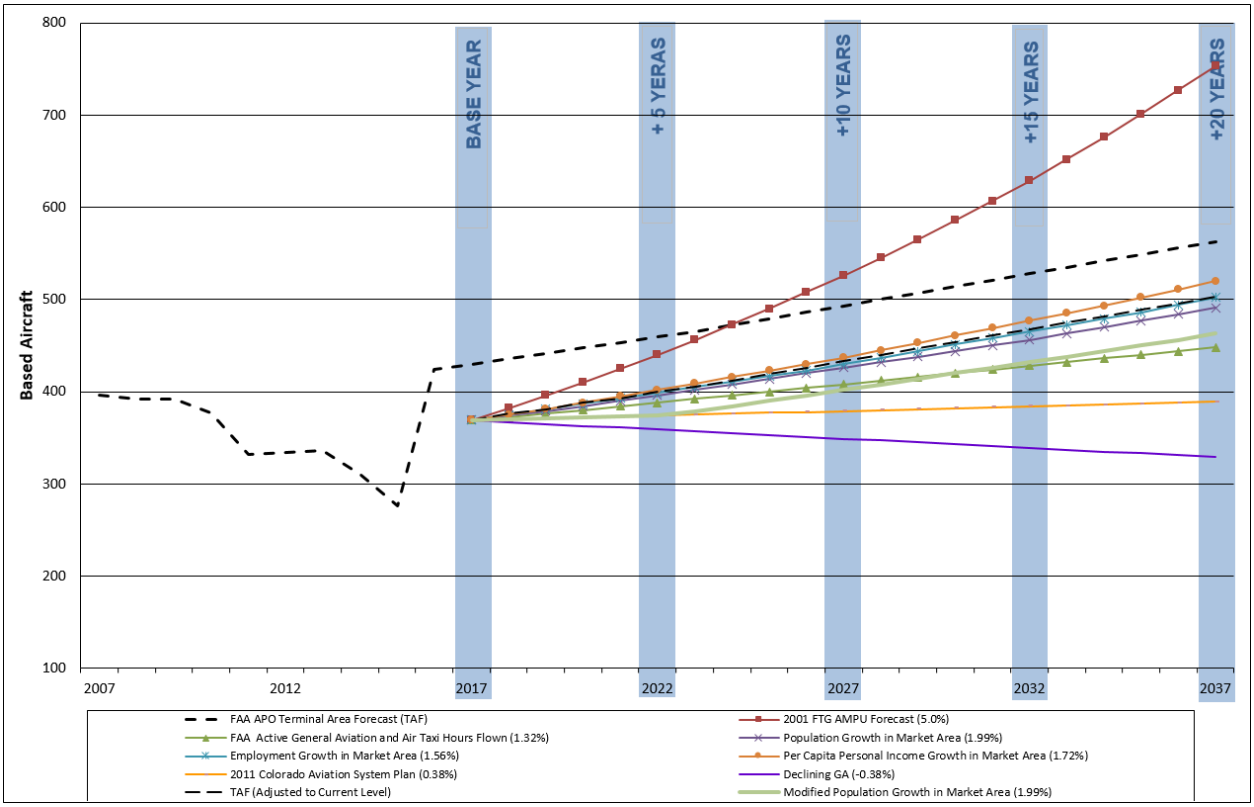
Source: Jviation
[1] Current (actual) data

The preferred aircraft operations projection for FTG represents an unconstrained projection based on existing market conditions and presumes that airport development needed to accommodate growth will be undertaken in a timely manner. This is especially relevant for infrastructure needed to support large scale hangar development for accommodating additional aircraft service companies at the Airport. Facilities needed for this type of growth are speculation and would require further study as to the exact time frame, tenants and uses of the proposed expansion. Impacts from this possible development would result in a growth of operations, which could set a new benchmark level of operations at FTG in the later years. Direct potential impacts to facilities will be discussed in following chapters.

3.8 Based Aircraft Forecast

The based aircraft forecast helps determine the future activity levels and the potential requirement for expanded or improved airport facilities. Following an airport-wide hangar inspection completed during July 2016, airport management provided documentation that indicated a lower number of current based aircraft (369) than the FAA 2017 TAF (429) and higher than FTG's last 5010 inspection (dated 12/31/2013) which reported 285. For this forecast, the 2016 hangar inspection totals have been used as the basis of the forecast. (Note that FTG has updated the FAA online aircraft database to reflect its surveyed totals.) The same methodologies used for operations forecasting have been utilized for forecasting based aircraft: socioeconomic analyses (including population, employment, and per capita income), time series analysis, and market share analysis. Additionally, forecasts associated with the 2004 Master Plan, the 2011 Colorado Aviation System Plan, and the FAA Aerospace Forecast 2017-2037 were considered. The results produced through the application of these various methodologies and resources are reflected below in **Figure 3-10.** Note that the FAA TAF forecast in this figure has been adjusted to reflect current based aircraft totals as reported by FTG.

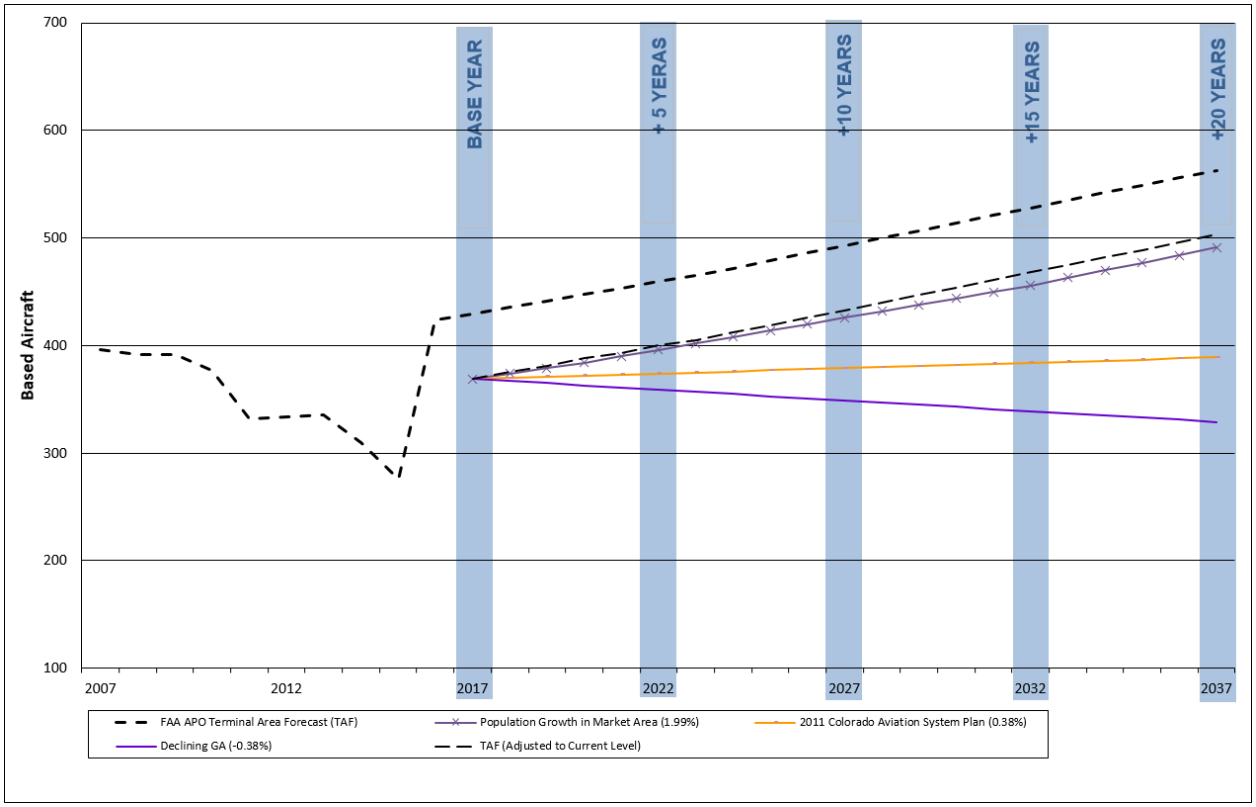
FIGURE 3-10 - FTG BASED AIRCRAFT RANGE OF FORECASTS



Source: Jviation

Three growth scenarios were used to forecast based aircraft at FTG, as well as consideration provided to the current TAF. The high growth scenario incorporates the Adams County population growth rate of 1.9 percent, the 2011 Colorado Aviation System Plan forecast for FTG (0.38 percent) reflects moderate growth, and a declining GA activity forecast (-0.38 percent) is the low growth scenario. These are reflected in **Figure 3-11** and **Table 3-9**. These forecast scenarios provide a range of 491 (high) to 329 (low) based aircraft by 2037, while the current TAF projects 563 based aircraft by the end of the 20-year planning period. Note that if the TAF were adjusted to reflect the actual number of aircraft currently based at FTG, that projection changes to 503 based aircraft by 2037, as shown in the following figure.

FIGURE 3-11 - FTG BASED AIRCRAFT FORECAST SCENARIOS



Source: Jviation

TABLE 3-9 - FTG BASED AIRCRAFT RANGE OF FORECASTS

Year	High (1.99%) Adams County Population	Medium (0.38%) CO Aviation System Plan	Low (-0.38%) Declining GA	FAA TAF (2017)	FAA TAF (adjusted to actual level)
2017[1]	369	369	369	429	369
2022	396	374	359	460	400
2027	426	379	349	493	433
2032	456	384	339	528	468
2037	491	389	329	563	503

Source: Jviation
[1] Current (actual) data

Preferred General Aviation Operations Forecast

Like the aircraft operations forecasts, the based aircraft forecast scenarios were presented to the FAA and the FTG AMP PAC in February 2016. Comments were received from the PAC and additional interviews with stakeholders were conducted. The Airport also provided updated based aircraft demand data that indicated a continued robust demand for basing aircraft in FTG hangars, as well as the potential establishment of a new flight school. Based on this data and coordination, the high growth forecast was identified as the recommended forecast scenario for FTG based aircraft.

3.9 Critical Design Aircraft

The Critical Aircraft is used to identify the design criteria for an airport. It is determined by the most demanding airplane, or family of airplanes, that accounts for at least 500 annual operations within the planning period. Formerly designated as the Airport Reference Code (ARC), the Runway Design Code (RDC) is a classification given to aircraft based on its maximum approach speed and wingspan. The FAA then uses this classification to apply specific airport design criteria appropriate to operational and physical characteristics of the aircraft types operating at that Airport. The RDC is applied to each separate airfield facility, and may be different if different Critical Aircraft are identified for each runway or airfield element.

The 2004 FTG Master Plan established the ARC (now defined as RDC) as a D-IV based on the need to accommodate the most demanding traits of a combination of the Airbus 300F (ARC/RDC C-IV) and the Grumman Gulfstream IV (ARC/RDC D-II). This classification was also based on the 2004 Master Plan's projection that FTG would realize significant air cargo operations (starting in 2005) that operate the A300F. When those air cargo operations did not materialize, the ARC/RDC was updated to a C-II based on the Bombardier CL 604 Challenger, a corporate business jet.

Specifically, FTG's current Airport Layout Plan indicates this RDC for both runways, with an existing Airport Approach Category (AAC) of C, and an Airplane Design Group (ADG) of II. This design category accommodates business jets up to the Gulfstream G-280, G-350, G-450; Falcon 2000 and 900; Bombardier Challenger 300/604/600; Cessna Citation X; and the Embraer Legacy 500/600, among others. An RDC of C-II also allows operations by smaller aircraft such as the Cessna Citation 1, 2, and CJ-series; Learjet 31, 35, 36, 45; Beech King Air 90, 200, and 350; Pilatus PC-12; TBM-850; as well as almost all piston engine aircraft. While FTG will occasionally accommodate operations by larger corporate jets such as the Gulfstream G-550 and Bombardier 700/Global 6000/Global Express (RDC C-III), these have not historically approached the FAA's 500 annual operation threshold for critical design aircraft status.

In 2017, the FAA's Traffic Flow Management System Counts (TFMSC) database indicated that the most demanding single aircraft that operated at FTG was the Beechcraft King Air twin-turboprop aircraft with 527 operations. Depending on its individual model and configuration, the King Air can have an RDC of B-I or B-II. However, this is anticipated to change in the future as FTG continues to accommodate a wide range of corporate jet aircraft ranging in size from the Cessna Citation Mustang (RDC B-I) to the Bombardier Challenger (RDC C-II) to the Gulfstream V/G500 (RDC C-III) at an increasing rate. As suggested earlier in this chapter, economic and industrial growth is steadily migrating eastward from Denver into Adams County. It is reasonable to conclude that FTG will continue to experience increasing rates of corporate jet activity in association with increasing industrial development within the area.

Table 3-10 provides a listing of the operational totals by corporate jet aircraft type currently being experienced at FTG. Note that the individual totals reflect an average of 2016 and 2017 to help account for potential anomalies. It should also be recognized that there are limitations to the TFMSC database in that it typically captures a relatively small percentage of the actual aircraft operations experienced,

meaning that the data included in the table is likely underestimated, potentially significantly.

TABLE 3-10 - CORPORATE JET AIRCRAFT OPERATIONS AT FTG

Aircraft Type	Average Annual Operations*
C25 - Cessna Citation (all C25 variants)	117
C500 - Cessna 500/Citation I	14
C510 - Cessna Citation Mustang	39
C525 - Cessna CitationJet/CJ1	140
C550 - Cessna Citation II/Bravo	47
C560 - Cessna Citation V/Ultra/Encore	60
C56X - Cessna Excel/XLS	62
C650 - Cessna III/VI/VII	6
C680 - Cessna Citation Sovereign	2
C750 - Cessna Citation X	15
CL60 - Bombardier Challenger 300/600/604	28
E135 - Embraer ERJ 135/140/Legacy	7
E50P - Embraer Phenom 100	10
E55P - Embraer Phenom 300	27
EA50 - Eclipse 500/550	41
F2TH - Dassault Falcon 2000	8
F900 - Dassault Falcon 900	13
FA50 - Dassault Falcon/Mystère 50	28
GLF5 - Gulfstream V/G500	15
H25B - BAe HS 125/700-800/Hawker 800	28
LJ35 - Bombardier Learjet 35/36	10
LJ45 - Bombardier Learjet 45	11
LJ60 - Bombardier Learjet 60	18
PRM1 - Raytheon Premier 1/390 Premier 1	11
Other Misc Aircraft	48
TOTAL:	**805**

Source: FAA Traffic Flow Management System Counts (TFMSC) database.
* Average of years 2016 and 2017.

Since FTG's current cumulative corporate jet aircraft operational totals exceed the 500-annual operational total, that this total is underestimated and that this total is reasonably anticipated to continue to increase into the foreseeable future, it is recommended that FTG continue to base its design aircraft on a corporate jet aircraft. Given that FTG's existing design aircraft (the Bombardier CL 604 Challenger) represents a reasonable balance of the widely varying operational requirements and specifications of these corporate jets, it is also recommended that the Challenger remain the design aircraft for FTG.

3.10 Summary of Preferred Forecasts

It is anticipated that FTG will experience moderate growth during the 20-year planning period that generally reflects the socioeconomic development trends of the area. Market demographic trends indicate that the Airport will slightly outpace prevailing national and state growth trends in general aviation. Based aircraft are expected to increase from approximately 369 aircraft to 491 aircraft by 2037. The Airport will also see an increase in the number of operations. By the end of the planning period, over 90,000 operations should be expected. Additional operations could be realized in future years should addition aviation businesses locate on or around the Airport. **Table 3-11** summarizes the projections contained in this chapter.

TABLE 3-11 - SUMMARY OF FTG PROJECTIONS

	2017[1]	2022	2027	2032	2037	CAGR[2]
Passenger Enplanements						
Air Carrier	0	0	0	0	0	0.0%
Commuter	0	0	0	0	0	0.0%
TOTAL ENPLANEMENTS	0	0	0	0	0	0.0%
Operations						
Itinerant						
Air Carrier	0	0	0	0	0	0.0%
Commuter/Air Taxi	439	468	532	587	678	2.31%
Total Commercial Operations	439	423	458	546	678	2.31%
General Aviation	31,685	34,236	39,592	43,649	50,363	2.47%
Military	548	574	602	601	629	0.73%
Local						
General Aviation	47,583	49,116	52,390	57,839	61,611	1.37%
Military	1,650	1,651	1,596	1597	1,542	-0.36%
TOTAL OPERATIONS	81,905	86,045	94,712	104,273	114,823	1.79%
Instrument Operations	6,552	6,884	7,577	8,342	9,186	1.79%
Peak Hour Operations	50.0	52.5	57.8	63.6	70.0	1.79%
Cargo (enplaned+deplaned tons)	0	0	0	0	0	0.0%
Based Aircraft						
Single Engine (nonturbine)	323	337	362	369	398	1.05%
Multi Engine (nonturbine)	36	36	38	41	44	1.01%
Jet Engine (turbine)	5	12	13	23	25	8.38%
Helicopter	5	12	13	23	25	8.38%
Other	0	0	0	0	0	0.0%
TOTAL BASED AIRCRAFT	369	396	426	456	491	1.44%

Source: Jviation
[1] Current (actual) data
[2] CAGR 2017-2037

Additionally, and as described previously, to secure FAA approval for the Master Plan activity projections, FAA requires a comparison of the forecasts to the annually-produced TAF, preferring that airport planning forecasts not vary significantly from the TAF. Specifically, the FAA looks at the airport's recommended passenger enplanements, commercial operations, and total operations forecasts to be within 10 percent of their five-year TAF and within 15 percent of their 10-year TAF. If they are not within these tolerances, an explanation must be provided. A comparison between the forecasts shows that the preferred projections are within FAA tolerances in **Table 3-12** .

TABLE 3-12 – COMPARISON OF FTG PROJECTIONS WITH FAA TAF

	Year	FTG Forecast	TAF[1]	Forecast / TAF (% diff)
Passenger Enplanements[2]				
Base year	2017	0	0	0.0%
Base year + 5 years	2022	0	0	0.0%
Base year + 10 years	2027	0	0	0.0%
Base year + 15 years	2032	0	0	0.0%
Commercial Operations[3]				
Base year	2017	467	467	0.0%
Base year + 5 years	2022	467	467	4.2%
Base year + 10 years	2027	467	467	13.9%
Base year + 15 years	2032	467	467	29.4%
Total Operations				
Base year	2017	81,905	82,562	0.8%
Base year + 5 years	2022	86,045	83,609	2.9%
Base year + 10 years	2027	94,712	84,349	11.6%
Base year + 15 years	2032	104,273	85,099	20.3%

Source: Jviation

[1] FAA TAF Issued January 2018.

[2] Includes only reported Air Carrier and Commuter enplanements (not air taxi, general aviation, etc.).

[3] Includes Air Carrier, Commuter and Air Taxi operations.

It is important to note that the recommended forecast for FTG is an unconstrained projection which has an inherent implication that all facilities necessary to accommodate the forecasted growth will be constructed, regardless of potential constraints to development. The following chapters of this Master Plan will explore the facility implications of accommodating the projected demand and design requirements.